

# Cloning after Dolly

## Professor Derek Burke

'Cloning' is a loose term used to describe everything from a new super race of identical near-robots (remember 'The Boys from Brazil'?) to propagating your roses. It actually means a twig, so it starts from the horticultural end, but is used much more widely.

Dolly was the first cloned mammal and must be the most famous sheep in the world. Two things made her famous: first that she is an artificially induced clone, genetically identical to a previously existing sheep, for Dolly can be thought of as a vertical twin with identical genes, in this case to the parent. Second is the way in which it was done. The scientists took the nucleus from a cell from the udder of an adult sheep and implanted it in an egg cell whose original nucleus had been removed. Very surprisingly, the adult cell DNA was able to give rise to a complete individual, not just more udder cells. This was surprising because, although at the earliest stage of development the DNA is still pluripotent, capable of generating the growth of the whole animal, later in development, specialization sets in, and cells become differentiated into heart cells, liver cells etc. The whole of the genetic material is still there, but most of it is switched off and only the genes relevant to that particular cell are active. It had been thought that this process of differentiation in mammals was irreversible, so that an udder cell could only give rise to more udder cells. But we now know that differentiation can be reversed.

This work was undertaken for serious, responsible scientific reasons, but in the popular mind the fuss was not generated by thoughts about animal cloning. It was the possibility of using the same technique to clone humans that caught the lurid imagination of many, from visions of worker clones, to the possibility of 'replacing' a dead parent or child. Of course such clones would be new people; just try telling identical twins that they are only one person! But there are some serious ethical issues to consider.

It is important to distinguish between reproductive cloning and therapeutic cloning which is discussed in the next paper. Human reproductive cloning would be exactly like Dolly; it would involve the creation of a cloned embryo which was then implanted in a woman's womb to develop to term and the birth of a human clone. On the other hand, therapeutic cloning would not result in the birth of a human clone, but would involve the growth of cellular human tissue of specific kinds for treatment of disease or to replace non-functional tissue or organs. It was reproductive cloning that all the fantastic speculations were about and its possibility has rightly resulted in a great deal of unease.

The House of Commons Science and Technology Select Committee issued a report very soon after the news of Dolly had become public, stating that there should be no creation of 'experimental human beings'. Reproductive human cloning would, in fact, be illegal in Britain under the provisions of the Human Fertilisation and Embryology Act but to ensure that no loophole remains, the current Government intends to introduce new legislation specifically banning human reproductive cloning.

The European Bioethics Commission has called for the banning of reproductive human cloning, asserting that every human being is entitled to their own individual and unique genetic identity. While the conclusion may be valid, the reasoning is questionable. What

about identical twins? They are genetically indistinguishable, but no one doubts they are two distinct and unique persons. The rights of one are not threatened by the existence of the other. So, although we are constrained by our genetic inheritance, we are not determined by it.

## Why are people so concerned?

1. "Going where God alone should go?" Many feel uneasy about these developments because they fear that natural barriers are being crossed; barriers that are dangerous or impious for humanity to transgress. Are we in danger of attempting to usurp the prerogatives of the Creator?

On the other hand, human beings have been intervening in nature to change 'natural' processes for many years. Medicine and surgery are obvious examples. Christians can see this activity, which is devoted to serious and beneficial ends, as an appropriate use of God-given human capacities, rather than an improper attempt to rival the Creator. Nevertheless, not everything that can be done experimentally should be done. There is always the possibility of the misuse of human powers.

2. Then there are those who are very concerned with animal rights, claiming that nothing should be done to animals that is not for their individual good. They oppose animal cloning, regarding the sorts of experiments that led to Dolly as being unacceptable. On the other hand, those who believe that there is an ethically justifiable use of animals, for example, eating meat, will not take so absolutist a view. They should, of course, insist that such activities must ensure proper animal welfare, minimisation of suffering, and seriousness of purpose. The Roslin experiments certainly fulfilled these criteria. In fact, cloned animals like Dolly are of such value and significance that they can be expected to be cared for like gold for the rest of their natural lives.

Cloning by nuclear transfer was first developed 40 years ago for frogs, and since the successful cloning of Dolly, has been used to make clones of sheep, pigs, mice, cows and goats and so technically it could probably be applied to people too. However the low efficiency of the procedure may restrict its immediate application even in animals - perhaps to the production of small herds of identical animals, although other specialised uses can be envisaged. For example, the technique could be used to inactivate potentially damaging prion genes in cattle, and possibly for the resurrection of endangered species, notably the gaur and possibly the bucardo, the Spanish mountain goat. (Nature 407, October 12th, 2000, p. 666).

3. Another concern is about safety. In the experiments that led to Dolly, 277 attempts at nuclear transplantation were made, but only 29 implantable embryos resulted and there was only one completed pregnancy and birth - Dolly. This appears to be true of other such cloning experiments. There is also some uncertainty about what 'age' Dolly will prove to be, her birth age or the age of the ewe that provided the nucleus. Will cloned animal show increased susceptibility to cancer and other diseases because their genes are already 'aged'? However, the first mouse to be cloned from an adult cell died recently at the age of two years and seven months, and since the average mouse's life is about two years, there does not seem to be premature aging. (Nature, 405, May 18th, 2000, p 268.)

So even if human reproductive cloning were considered ethically acceptable on other grounds, there would still be very severe questions about the safety of the procedure and the

degree of wastage that could occur. These questions could only be settled, first by extensive animal investigations and then experiments with human subjects. This is also considered ethically unacceptable.

However talk continues; The Times carried a two page spread on February 20th, 2001 headed 'I'm not a monster' which refers not to a human clone, but to an Italian, Professor Antinori, who is President of the Italian Society of Reproductive Medicine, and who wants to 'clone' humans by taking cells from the man's skin and fusing them with female egg cells extracted from his wife's ovaries, after the original cell nucleus has been removed. The embryo, after stimulation, is then to be reimplanted in the woman's womb. So the child, if one were to be born, would be the natural child of those parents and would not be a clone, but the risks are huge. He says that all he doing is finding a way around a barrier as in IVF, and that is true, but he is being cavalier about the risks and Ian Wilmut, who cloned Dolly, says that the proposals are 'irresponsible'. However despite the risk he says he has a long list of applicants from all over the world.

Finally to go back to proper cloning. I think that many of the reasons suggested for human reproductive cloning, such as replacement of lost kin or the perpetuation of particular individuals, are not only fallacious because they fail to acknowledge the uniqueness of every human person, but also they are totally ethically unacceptable because of their instrumental treatment of the new human being. Every child that is born is to be valued for his or her own sake and not as the replacement or perpetuation of another.

Similar objections must be made to proposals for the production of children whose genetic make-up has been carefully crafted to the specifications of somebody else. Such 'designer babies' would represent the ethically unacceptable commodification of children, but it is not going to stop such attempts, especially in the United States where such experiments are only forbidden if funded by the Federal Government not if they are funded from private sources.

It is clear that as our knowledge continues to expand we need increasing wisdom to know where to draw lines between what can be done and what should be done.

Derek Burke